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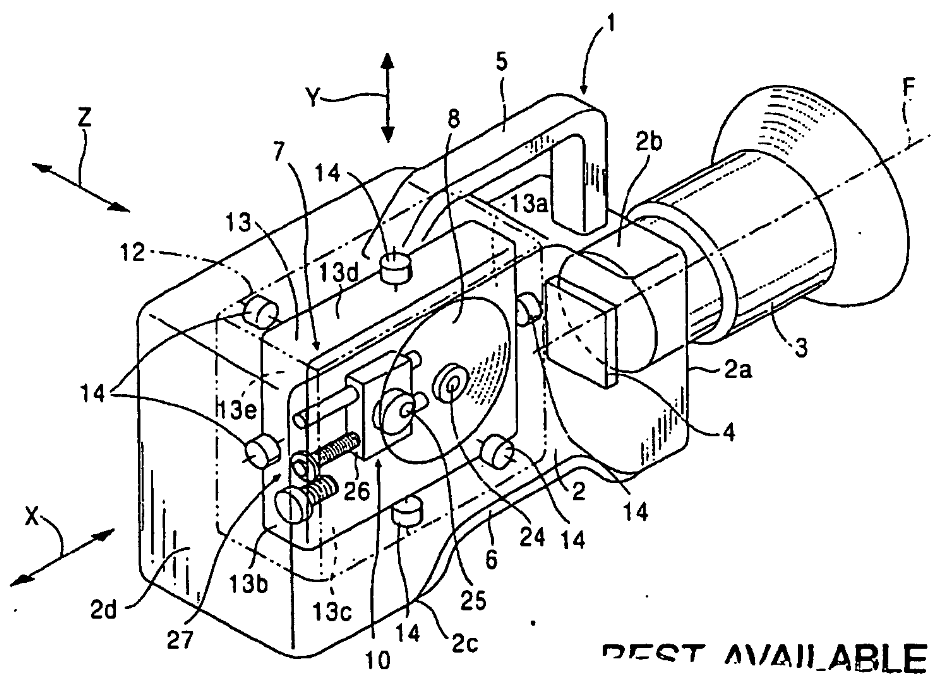
(54) Disk recording apparatus

(57) Disk recording apparatus has a built-in disk device (7) which is elastically supported by a plurality of insulators (14), and the feeding direction of a carriage feeding mechanism (27) for an optical disk (8) and an optical pick-up (10) is substantially parallel to the optical axis (F) of a photographic lens (3) to obtain a marked improvement in terms of vibration-proofness and impact-proofness.

FIG. 1



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[Outline of Video-Cam-Corder]

First, the outline of a video-cam-corder will be described. As shown in Figs. 1 through 3, this video-cam-recorder, indicated by numeral 1, includes a camera main body 2, to the front side 2a of which a photographic lens 3 is mounted. Inside the camera main body 2, there is provided an imaging apparatus 4 comprising a CCD or the like and arranged in the optical axis F of the photographic lens 3. This imaging device 4 generates image information from an optical image supplied through the photographic lens 3. A grip 5 for handling the camera is attached to the upper portion 2b of the camera main body 2, and a shoulder pad 6 is attached to the lower side 2c of the camera main body 2. To the rear side 2d of the camera main body 2, a battery, a power source cord, etc. (which are not shown) are detachably mounted as needed. In this video-cam-corder 1, a disk device 7 is used as the image information recording device. The disk device 7 is contained in the camera main body 2 or in an adaptor (not shown) which is detachably mounted to the rear side 2d of the camera main body 2 (Hereinafter, only the case will be described in which the disk device 7 is contained in the camera main body 2). In the disk device 7, a so-called optical disk 8, comprising an optic disk or a magneto-optic disk, is mounted uncovered or in a state in which it is accommodated in a disk cartridge 9. The disk device 7 is equipped with an optical pick-up 10 serving as the pick-up (head) for recording and reproducing image information on and from the optical disk 8.

Thus, in this video-cam-corder 1, image information (image signal) obtained by the imaging device 4 is recorded on and reproduced from the optical disk 8 of the built-in disk device 7 by means of the optical pick-up 10. This disk device 7 is compact. Further, a digital signal processing method is adopted, in which image information is recorded on the optical disk by means of a digital signal, so that the recording capacity of the optical disk 8 is remarkably large. Further, in this disk device 7, image information is recorded on and reproduced from the optical disk 8 by means of the optical pick-up 10, so that the recorded image information can be quickly accessed; the photographed image information can be quickly recorded, edited, transferred, etc. Thus, the video-cam-corder is most suitable, in particular, for broadcasting and business applications.

[Insulator]

Next, a plurality of insulators, which are mounted in the camera main body 2 so as to elastically support the disk device 7, will be described. As shown in Figs. 1 through 3, inside the camera main body 2, there is arranged a vertical camera main body chassis 12, which is in the form of a casing having one side open. The disk device 7 is accommodated in the camera main body chassis 12 in an upright (vertical) position. Inside the camera main body chassis 12, there is provided a disk device chassis 13 whose outer periphery is elastically supported by a plurality of insulators 14 in the longitudinal direction X, the vertical direction Y, and the lateral direction Z. In many of these insulators 14, a spring element 15 and a dashpot element 16 are incorporated.

That is, the load of the disk device chassis 13 is directly applied to the plurality of insulators 14, which support the front and rear sides 13a and 13b, the lower side 13c and one side surface 13e of the disk device chassis 13. In view of this, as shown, for example, in Fig. 4, each of these insulators 14 is composed of a coil spring 17 constituting the spring element 15 and an elastic member 18 comprising rubber or the like constituting the dashpot element 16.

In Fig. 4, a pin mounting plate 20 is attached to the disk device chassis 13 by a pair of fastening screws 19, and a central pin 21 is inserted through the center of the pin mounting plate 20 and fixed thereto by screwing, crimping, etc. The outer periphery of the central pin 21 is surrounded by the cylindrical elastic member 18, which is fitted into a cylindrical portion 22 integrally formed in the camera main body chassis 12 by burring or the like. Initial compressive stress is applied to the elastic member 18 when it is fitted into the cylindrical portion 22. The coil spring 17 is arranged around a flange portion 18b of the elastic member 18 and between the camera main body chassis 12 and the disk device chassis 13, with initial compressive stress being applied to the coil spring 17. By sealing a liquid in the elastic member 18, the coil spring 17 could be omitted.

Usually, the load of the disk device chassis 13 is not directly applied to those insulators 14 which support the upper side 13d of the disk device chassis 13. Thus, these insulators may be a simplified type in which either the spring element 15 or the dashpot element 16 is omitted, as shown in Fig. 5. In Fig. 5, only the elastic member 18 is used, and the coil spring 17 is omitted. The elastic member 18 is supported by the central pin 21 shown in Fig. 4.

Due to the plurality of insulators 14, constructed as described above, any external vibration or impact applied to the camera main body chassis 12 can be quickly absorbed and attenuated by the spring elements 15 and the dashpot elements 16. Thus, a very high level of shock absorbing ability can be obtained. Due to this effect, any external vibration or impact is not easily transmitted to the disk device chassis 13, whereby the vibration-proofness and the impact-proofness of the disk device 7 can be remarkably improved.

[Outline of Disk Device]

Next, the outline of the disk device 7 will be described. As shown in Figs. 1 through 3, the disk device 7 has a spindle motor 24, to which the optical disk 8 is attached at right angles and which is driven to rotate. The optical pick-up 10 has a carriage 25 to which an

[Feeding Mechanism]

Next, the carriage feeding mechanism 27 will be described. As shown in Figs. 6 and 7, in this carriage feeding mechanism 27, the objective lens 25 is transferred by the carriage 26 along the horizontal reference line P1 of the optical disk 8, that is, in the longitudinal direction X, which is parallel to the optical axis F. The carriage 26, which is guided on a guide shaft 39 that is parallel to the optical axis F, is driven by a motor in the X-direction on the guide shaft 39. Regarding the motor, it might be possible to adopt a linear motor which drives the carriage 26 in a non-contact state by using a magnetic circuit. However, to prevent as much as possible track deviation of the spot of the laser beam LB due to the slight vibrations, impacts, etc. generated during video recording, it is desirable to adopt a carriage feeding mechanism 27 described below.

The carriage feeding mechanism 27 shown in Fig. 6 adopts a screw feeding mechanism 44, in which the carriage 26 is threadedly connected to a feeding screw 40 which is parallel to the guide shaft 39 through the intermediation of a nut 41; the feeding screw 40 is rotated in the normal and reverse directions by a DC motor 42 through a gear train 43, whereby the carriage 26 is screw-fed in the X-direction along the guide shaft 39. The carriage feeding mechanism 27 shown in Fig. 7 adopts a rack/pinion mechanism 47, in which the carriage 26 is guided by a pair of parallel guide shafts 39 and in which a rack 45 that is parallel to the guide shafts 39 is attached to the carriage 26. A pinion 46 that is in mesh with the rack 45 is rotated in the normal and reverse directions by the DC motor 42 through the gear train 43, whereby the carriage 26 is translated in the X-direction along the guide shafts 39 through the intermediation of the rack 45. The screw feeding mechanism 44 and the rack/pinion mechanism 47, described above, have a contact structure in which the DC motor 42 and the carriage 26 are mechanically connected to each other.

Further, as shown in Fig. 13, it is also possible to provide the feeding screw 40 on the upper side and the guide shaft 39 on the lower side, or, as shown in Fig. 14, to provide the rack 45 on the upper side of the carriage 26.

[Biaxial Actuator]

Next, the biaxial actuator 31 mounted on the carriage 26 will be described. To prevent as much as possible oscillation of the objective lens 25 due to the vibrations, impact, etc. generated during video recording, it is desirable to use a balanced type (shaft slide type) biaxial actuator as shown in Fig. 8. In this balanced type biaxial actuator 31a, a shaft 52 is fastened to a base yoke 51 so as to be parallel to the lateral direction, i.e., the Z-direction, and a round bobbin 53, to which the objective lens 25 is fixed at an eccentric position, is mounted so as to be slidable on the shaft 52 in the lateral direction, i.e., the Z-direction, and rotatable in the longitudinal direction, i.e., the X-direction. A focusing coil 54a and tracking coils 55a are attached to the outer periphery of the bobbin 53, and magnets 56a and yokes 57a are fastened to the base yoke 51 so as be arranged in an arcuate form on either side of the bobbin 53, whereby a magnetic circuit is formed. By virtue of this magnetic circuit, focusing adjustment of the objective lens 25 is effected integrally with the bobbin 53 in the lateral direction, i.e., the Z-direction, along the shaft 52, and tracking adjustment of the objective lens 25 is effected in the longitudinal direction, i.e., the X-direction, around the shaft 52. Thus, this balanced type biaxial actuator 31a is strong with respect to all the directions. In particular, vibrations, impacts, etc. in all the directions, i.e., the vertical direction Y, the longitudinal direction X, and the lateral direction Z, can be received by the shaft 52, whereby a marked improvement can be achieved in terms of vibration-proofness and impact-proofness.

Fig. 9 shows an unbalanced type (leaf spring type) biaxial actuator 31b. In this unbalanced type biaxial actuator, a block 60 is fastened to one end of a base yoke 51 by means of screws or the like. Four parallel leaf springs 61 form a quadruple link mechanism, and one end of each of these leaf springs 61 is fastened to the block 60. The other ends of these leaf springs 61 are fastened to a bobbin 62, and the objective lens 25 is secured at the central position of the bobbin 62. A focusing coil 54b and tracking coils 55b are attached to the outer periphery of the bobbin 62, and magnets 56b and yokes 57b are fastened to the base yoke 51 arranged on either side of the bobbin 62, whereby a magnetic circuit is formed. By virtue of this magnetic circuit, focusing adjustment of the objective lens 25 is effected integrally with the bobbin 62 in the lateral direction Z while utilizing the deflection of the parallel leaf springs 61, and tracking adjustment of the objective lens 25 is effected in the longitudinal direction X. Thus, this unbalanced type biaxial actuator 31b is strong only in the longitudinal direction of the parallel leaf springs 61. However, by matching the longitudinal direction of the parallel leaf springs 61 with the vertical direction Y, it is possible to receive vibrations, impacts, etc. in the vertical direction Y by the parallel leaf springs 61. Thus, this unbalanced type biaxial actuator 31b also makes it possible to achieve an improvement in vibration-proofness and impact-proofness.

While the present invention has been described with reference to an embodiment of a combination camera/video-recorder system, the present invention is not restricted to the embodiment described above. For example, the disk recording medium of the disk device is not restricted to an optical disk, such as an optic disk or a magneto-optic disk. It may also comprise a magnetic disk. Further, the combination camera/video-recorder system of the present invention is not restricted to a video-cam-corder. The present invention is also applicable

a camera main body equipped with a photographic lens and able to output image information in accordance with an optical image obtained through the photographic lens:
a disk device for recording said image information on a disk recording medium; and
a plurality of insulators elastically supporting the disk device inside the camera main body.

11. Disk recording apparatus according to Claim 10, wherein the plurality of insulators include spring elements and dashpot elements.

12. Disk recording apparatus according to Claim 10, wherein the plurality of insulators are provided between the lower surface of the camera main body and the upper surface of the disk device, between the upper surface of the camera main body and the lower surface of the disk device, and between a side surface of the camera main body and a side surface of the disk device.

13. Disk recording apparatus according to Claim 12, wherein, of the plurality of insulators, those insulators which are provided between the lower surface of camera main body and the upper surface of the disk device have only either spring elements or dashpot elements, and wherein the insulators provided at the other positions have both spring elements and dashpot elements.

FIG. 2B

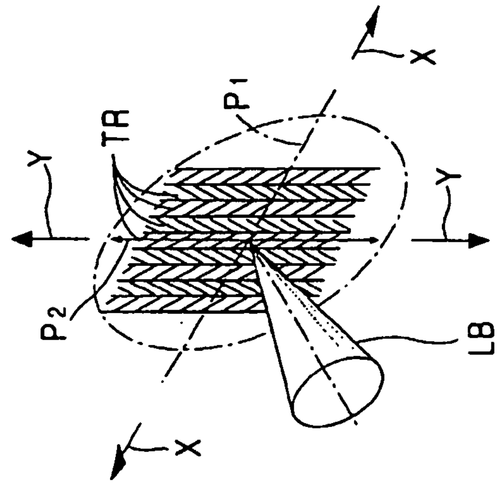


FIG. 2A

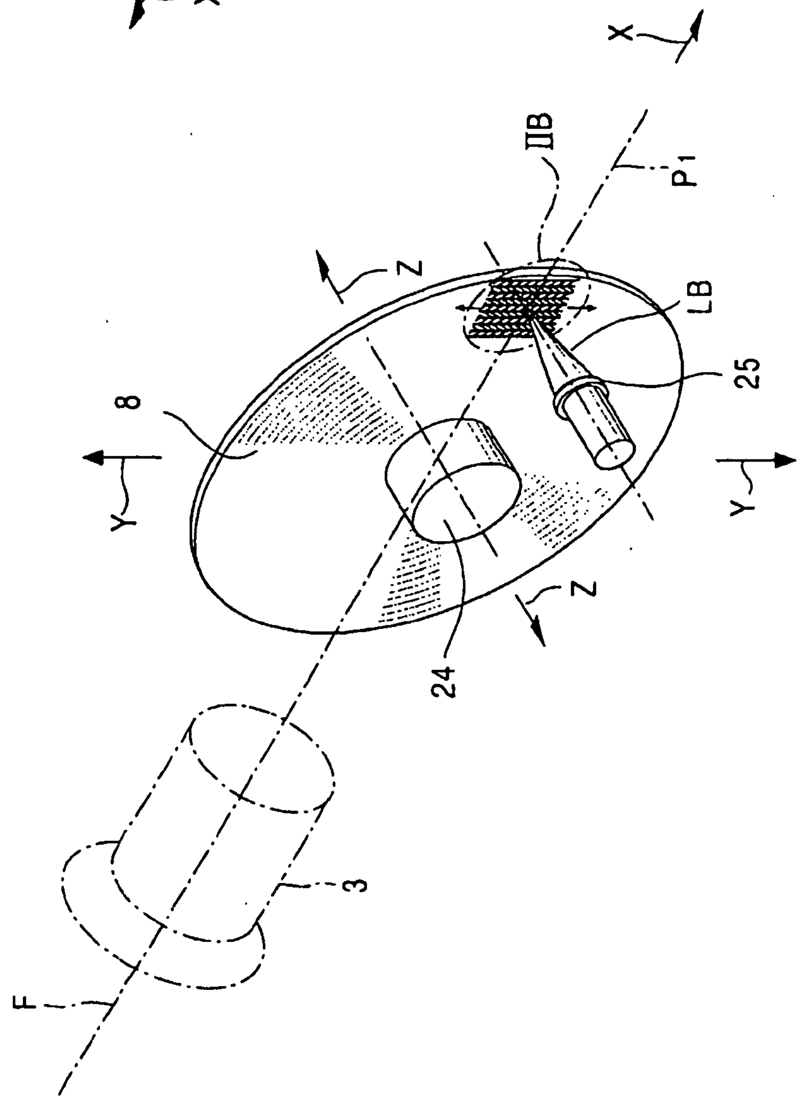


FIG. 4

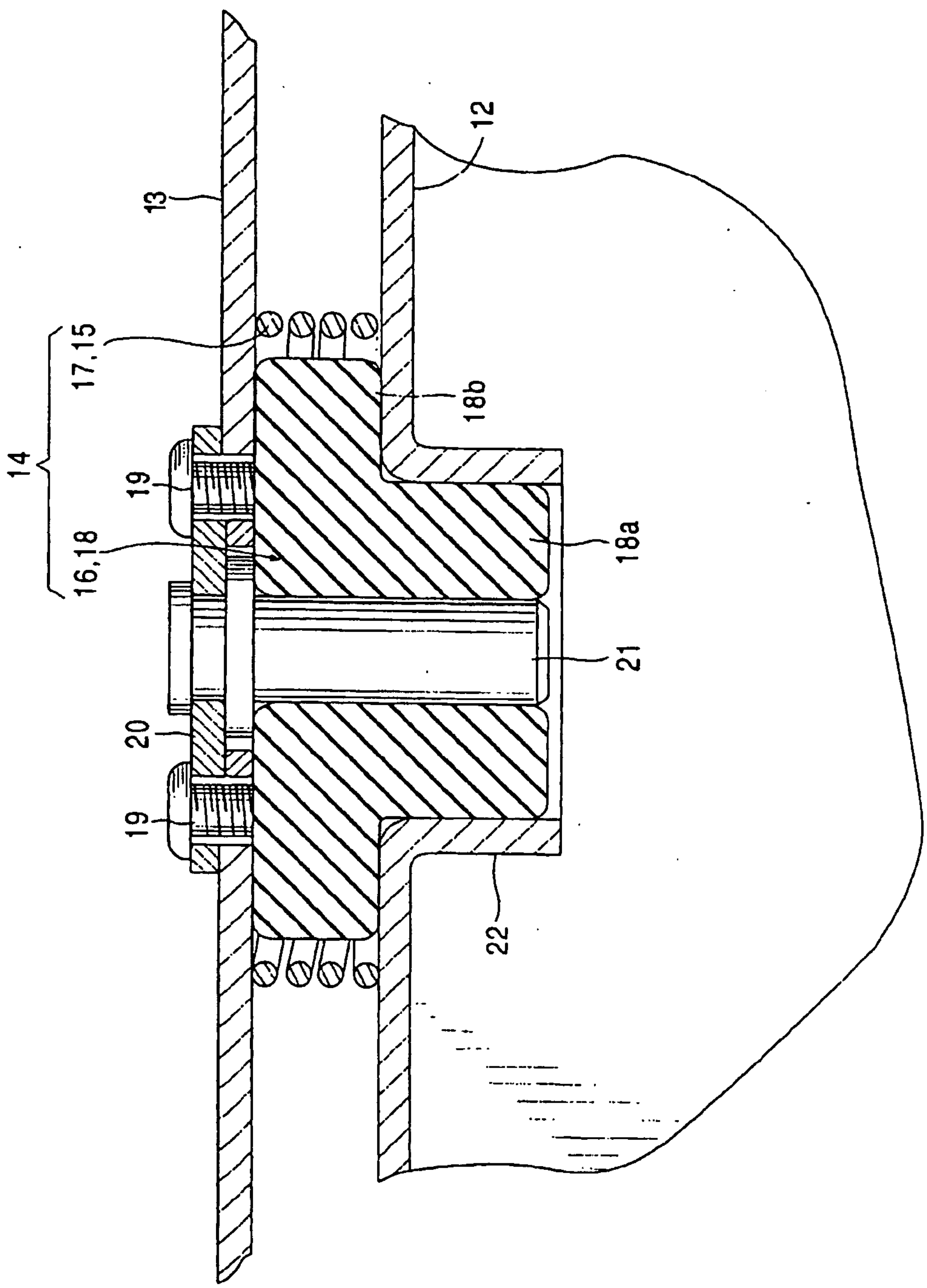


FIG. 6

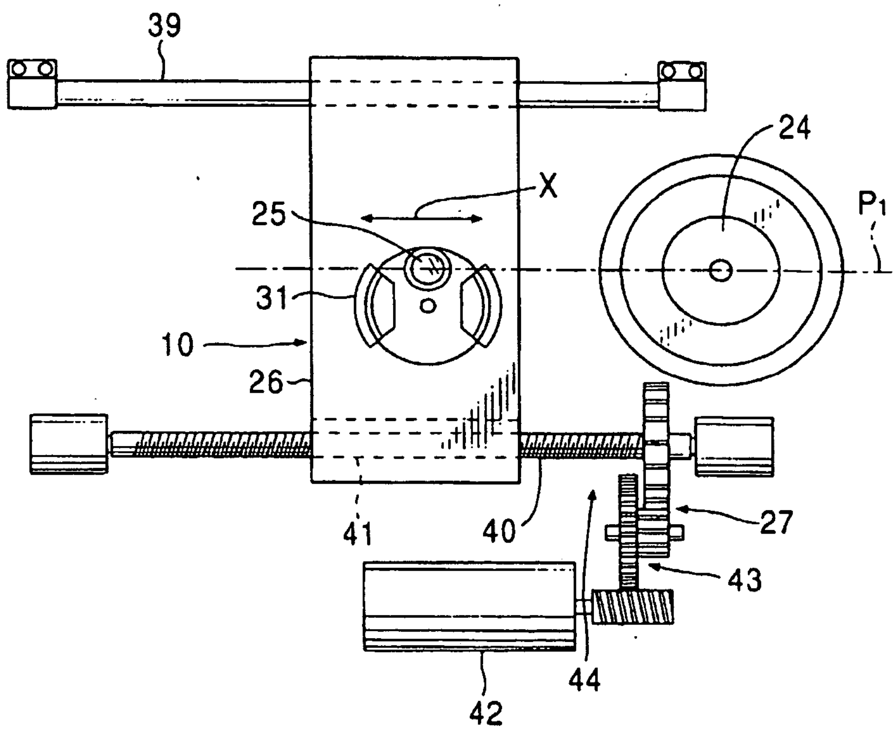


FIG. 8

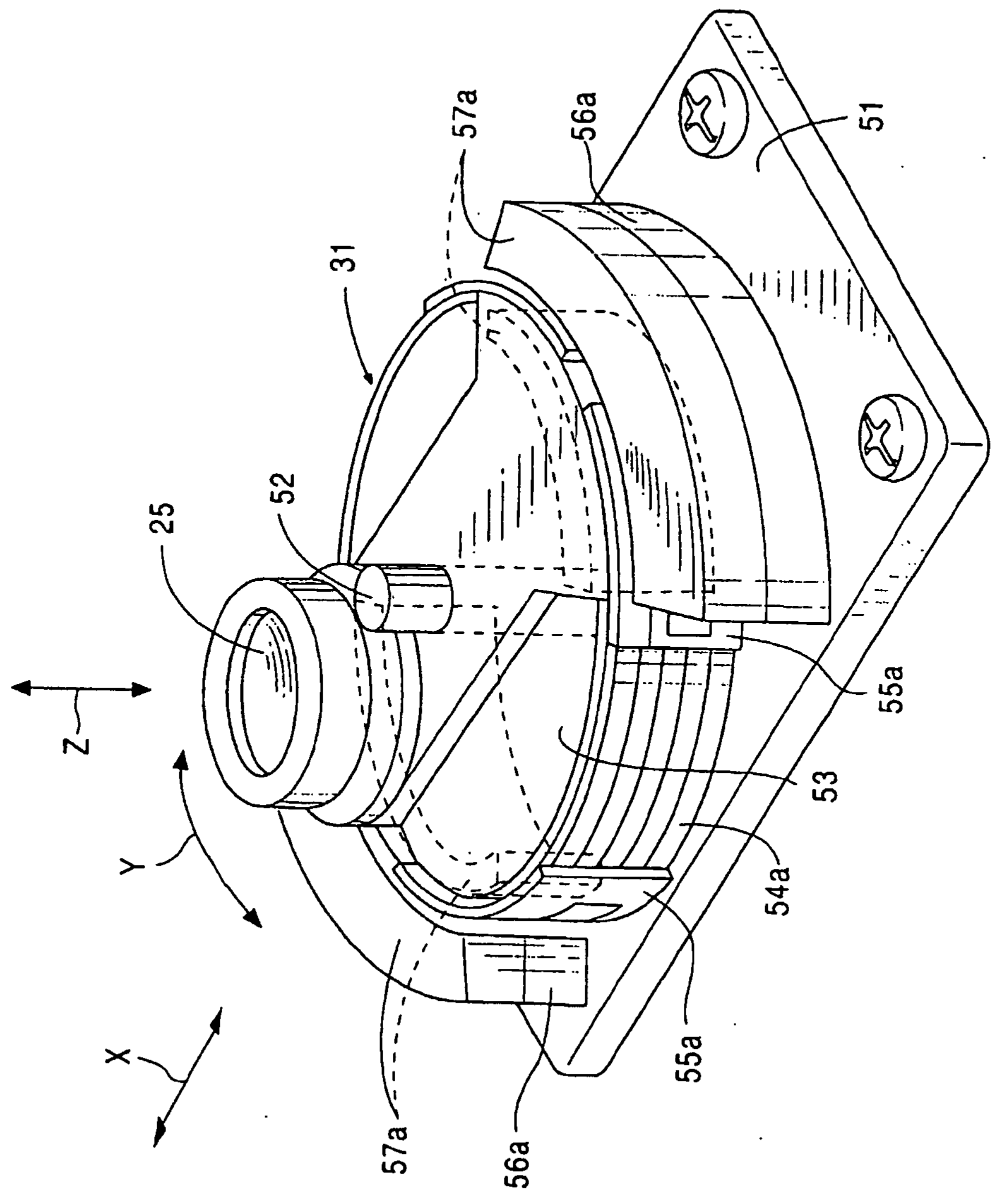
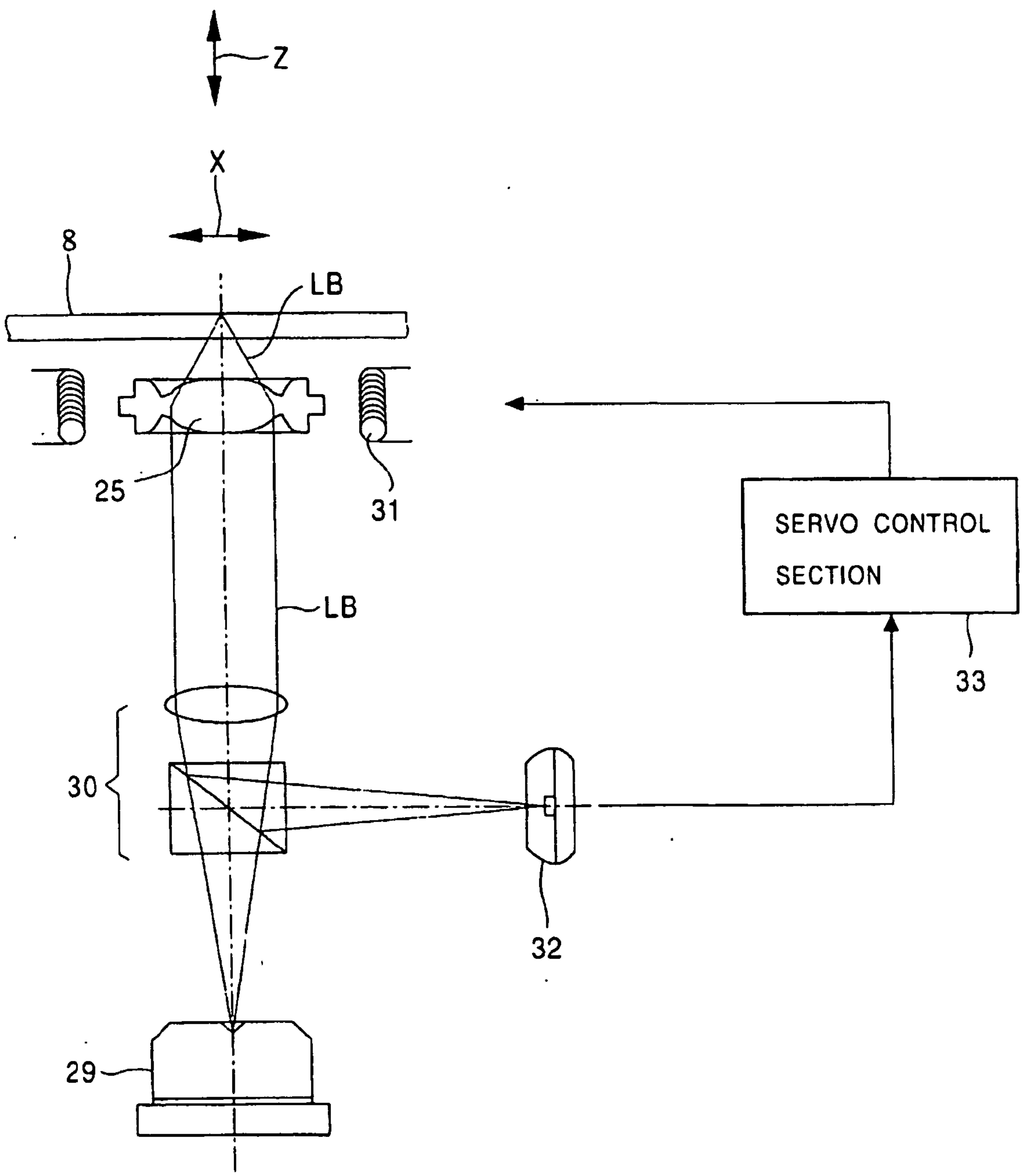


FIG. 10



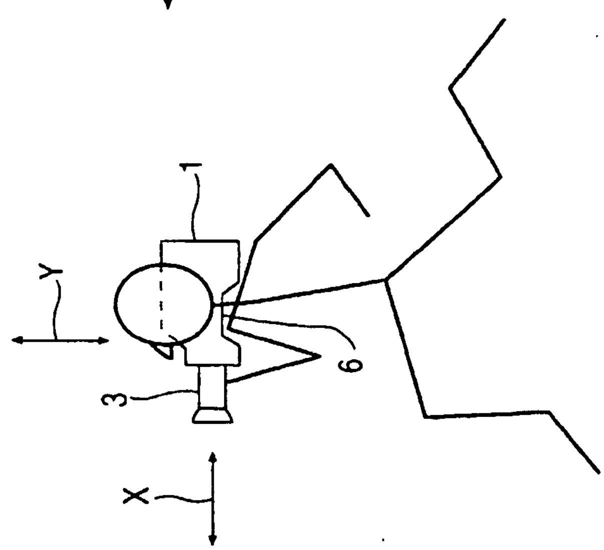


FIG. 12A

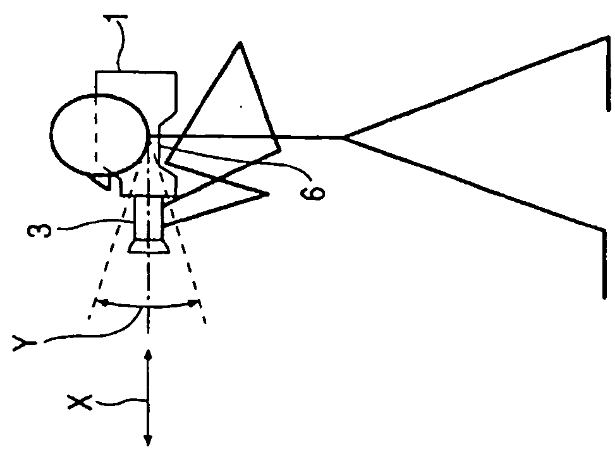


FIG. 12B

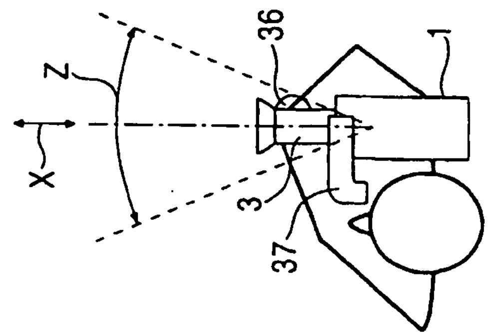


FIG. 12C

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EUROPEAN SEARCH REPORT

Application Number
EP 97 31 0323

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP 0 271 869 A (CASIO COMPUTER CO LTD) * column 3, line 15 - line 47 * * column 4, line 50 - column 5, line 47 * * column 17, line 56 - column 18, line 5; figures 1-5 *	1,2,4,5	G11B31/00
X	DE 41 08 307 A (OLYMPUS OPTICAL CO) * column 4, line 27 - column 5, line 65 * * column 9, line 60 - column 10, line 11; figure 1B *	1-7	
A	US 4 849 819 A (ISHIGURO YASUAKI ET AL) * column 3, line 62 - column 5, line 8; figures 5-9 *	1,8-11	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
G11B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 April 1998	Ressenaar, J-P

CATEGORY OF CITED DOCUMENTS

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